Performance, carcass and meat quality differences between gilts and immunocastrates in diverse pig crossbreeds

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Introduction

For decades, pig breeding in Flanders has focused strongly on a high carcass lean meat content and low feed conversion ratio. However, there is increasing concern about inferior sensory and technological meat quality. One problem is the high incidence of pale, soft and exudative meat (Vermeulen et al., 2015). This negatively affects the sensory quality of fresh meat and results in significant production losses during processing. In addition, as a result of the selection for a high carcass lean meat content, the meat is nowadays characterized by a low intramuscular fat (IMF) content (Pietruszka et al., 2015, De Smet et al., 1996), which leads to poor flavor (Verbeke et al., 1999). The objective of this study is to evaluate the crossbred offspring of three terminal sire lines on performance, carcass quality and loin meat quality.

Material & Methods

Across three rounds, 215 pigs (110 gilts and 105 immunocastrates) divided in 43 pens were evaluated. The pigs were crosses of a hybrid sow (Topigs 20) and three types of terminal sire line boars: 1) Belgian Piétrain (BP), positive for the stress sensitivity gene (*RYR1*), 2) French Piétrain (FP) and 3) Canadian Duroc (CD), both stress negative. The pigs were raised in pens (five animals per pen) per terminal cross and gender. The male pigs were immunocastrated using two vaccinations of Improvac® (Zoetis, Belgium), carried out at an average pen weight of 55 kg and 85 kg. The pigs had free access to water and were fed *ad libitum*. Three phase feeding was used: from the beginning at nine weeks up to 55 kg, from 55 to 85 kg and from 85 kg to slaughter. All pigs received the same diet. Daily feed intake (DFI), daily weight gain (DG) and feed conversion ratio (FCR) were measured per pen. The pigs were slaughtered per pen one week after the average pen weight reached 108 kg. A total of 120 pigs (20 pigs/crossing/sex) were selected to assess carcass and meat quality. Hot carcass weight was recorded and used for calculating dressing yield. Carcass lean meat content was determined using the AutoFOM III system (Frontmatec A/S, Denmark). The initial pH of the loin was measured at the slaughterline, 35 min. after slaughter. The next day, the loins of the 120 selected pigs were evaluated with a gravimetric EZ-drip loss method (Christensen, 2003) and samples were taken for the determination of the intramuscular fat content with the "Bligh & Dyer method" (Hanson & Olley, 1963). For statistical analysis of performance data, a linear mixed model was used with pen as experimental unit, terminal sire line, sex and initial weight as fixed effects and round as random effect. For carcass and meat quality, a linear mixed model was used with pen as experimental unit, and terminal sire line, sex and cold carcass weight as fixed effects. Reference number of pen/compartment was included as random effect to account for repeated measurements within the pen. Round and slaughter date were also included as random effect. All statistical analyses were performed with R 3.3.3 (R Core Team, 2016).

Results & Discussion

The results are summarized in Table 1. The CD grew faster than FP, which in turn grew faster than the BP. The DFI of the BP was significantly lower compared to the FP and the CD. The FP had a significantly higher FCR compared to the BP, while it was not possible to differentiate the FCR between the CD and the other two sire lines. These results are in line with Edwards et al. (2003) who evaluated the difference in performances between crossbred offspring with a Duroc and a Piétrain sire line, while Morales et al. (2013) found a higher FCR for crossbred offspring with a Duroc compared to Piétrain sire line. The immunocastrates had a higher growth rate than gilts, which is in line with the study of Aluwé et al. (2016). The dressing yield of the BP was significantly higher than FP, which was in turn higher than CD. The observed difference might be due to the higher weight of the gastro-intestinal package as a result of a higher DFI (Gispert et al., 2010). The lean meat content of the BP was highest

and the one of CD lowest. These results confirm previous studies where the offspring of a Duroc sire line was compared with a Piétrain sire line (Edwards et al., 2006; Morales et al. 2013). Dressing yield was higher for gilts compared to immunocastrates, while it was not possible to differentiate the lean meat content between the sexes. Similar results were found by Morales et al. (2013), but Aluwé et al. (2016) also found a higher lean meat content for the gilts compared to IC. The initial pH of the BP was lower compared to the FP and CD, which is in line with the well established effect of the stress sensitivity gene (*RYR1*) on the rate of pH fall (De Smet et al., 1996). This was not entirely reflected in the drip loss percentage, as this was clearly lower for CD than for FP. In addition to the stress sensitivity of the BP, the different genetic background of the Piétrain breed versus Duroc breed might contribute to these differences. As well, a higher lean meat content has been negatively correlated with the water holding capacity (Lonergan et al., 2001; Edwards et al., 2003). The IMF content was the highest for the CD (3.01%, BP: 1.99%, FP: 2.54%). Similarly, the higher IMF content in CD vs FP and in FP vs BP can be explained by the negative correlation between lean meat content and IMF content (Pietruszka et al., 2015; Lonergan et al., 2001). There was no difference between the sexes for $pH_{35\ min}$, IMF and drip loss. These observations were in line with the studies of Aluwé et al. (2016) and Morales et al. (2013).

Table 1: Effect of terminal sire line and sex on feed conversion ratio, carcass and meat quality.

	TERMINAL SIRE LINE (TSL)			SEX (S)			P-VALUE		
	BP[1]	FP[2]	CD[3]	Gilts	IC[4]	RMSE	TSL	S	TSL x S
DAILY GAIN (G/DAY)	933[a]	1053[b]	1106[c]	990	1093	33.5	**<0.001**	**<0.001**	NS
DAILY FEED INTAKE (G/DAY)	2173	2565	2661	2453	2535	110	**<0.001**	**0.011**	0.028
FEED CONVERSION RATIO (G/G)	2.33[a]	2.45[b]	2.41[ab]	2.48	2.32	0.10	**0.016**	**<0.001**	NS
DRESSING YIELD (%)	78.4[c]	77.9[b]	76.5[a]	78.2	76.3	0.96	**<0.001**	**<0.001**	NS
LEAN MEAT CONTENT (%)	63.6[c]	59.8[b]	58.9[a]	61.0	60.5	1.68	**<0.001**	0.126	NS
$PH_{35\ MIN}$	6.51[a]	6.63[b]	6.66[b]	6.58	6.62	0.19	0.006	0.301	NS
INTRAMUSCULAR FAT (%)	1.99[a]	2.54[b]	3.01[c]	2.51	2.52	0.53	**<0.001**	0.842	NS
DRIP LOSS (%)	7.68[a]	7.04[b]	4.87[c]	6.48	6.56	1.59	**<0.001**	0.643	NS

[abc] Different lettres indicate significant difference between the groups of terminal sire lines($P < 0,05$)

[1] Belgian Piétrain. [2] French Piétrain.. [3] Canadian Duroc. [4] Immunocastrates. [5] Root mean square error.

Conclusions

Present results show that crossbred pigs from the BP sire line have a better feed conversion ratio and carcass quality compared to pigs from the FP or CD, but a lower technological quality. Pigs from the CD sire line have a lower carcass quality compared to the FP, but the water holding capacity and IMF percentage is superior. Meat quality was not different between gilts and immunocastrates.

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